1987

# Flood Insurance Study, City of Park City, Utah, Summit County

Federal Emergency Management Agency

# FLOOD INSURANCE STUDY

COMPLETED

36

# CITY OF PARK CITY, UTAH

## SUMMIT COUNTY

JULY 16, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 490139

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.



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FLOOD INSURANCE STUDY
CITY OF PARK CITY, SUMMIT COUNTY, UTAH

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Park City, Summit County, Utah and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence; and the State (or other jurisdictional agency) will be able to explain them.

## 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U. S. Army Corps of Engineers (COE), Sacramento District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-84-E-1506, Project Order No. 1. This study was completed in January 1986.

## 1.3 Coordination

A combined precontract and initial coordination meeting was held on August 2, 1983. Representatives of the study contractor, the State of Utah, and the community of Park City attended the meeting. Flood insurance, in general, and this Flood Insurance Study, in particular, were discussed. Information on study procedures and the types of data required to make the study was presented by the study contractor representative, and the streams and areas to be studied by detailed and approximate methods were identified.

In January 1984, a notice of study initiation, which contained a request for pertinent data, was sent to various Federal, State, and local agencies and individuals. An announcement of the intent to perform a flood elevation study in Park City was published in The Park Record on February 9, 16, and 23, 1984. Direct contacts for information were made with representatives of the City of Park City.

On August 22, 1986, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community, FEMA and the study contractor.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Park City, Summit County, Utah. The area of study is shown on the Vicinity Map (Figure 1).

The streams studied by detailed methods were Silver Creek and its three main tributaries - Deer Valley Creek, Ontario Creek and Empire Creek. The detailed studies began at the northeastern boundary of Park City and extended to the headwaters of the four streams.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through January 1991.

One stream, Woodside Gulch, a tributary to Empire Creek, was studied by approximate methods. Approximate analyses are used to study those areas having a low development potential or minimal flood hazards.

The original scope of work for this study included the streams in Thaynes Canyon and Treasure Hollow. These two streams were studied by approximate methods and tentative floodplains were delineated. However, after field inspection of the floodplain areas, it was concluded that the inundation during a 100-year flood on both streams was too shallow and widely dispersed to define reasonable and meaningful floodplain boundaries. Therefore, the two streams were deleted from the study.

The scope and methods of study were proposed to, and agreed upon by, FEMA and the community of Park City. All flows in the study area drain to the Weber River via Silver Creek. The streams and respective stream reaches studied are listed below:

| | Initial Scope of Study (miles) | | Final Scope of Study (miles) | |
|---|---|---|---|---|
| Stream | Detailed | Approximate | Detailed | Approximate |
| Silver Creek | 3.5 | 0.0 | 3.6 | 0.0 |
| Deer Valley Creek | 0.9 | 0.0 | 0.0 | 0.4 |
| Ontario Creek | 0.8 | 0.0 | 0.0 | 0.8 |
| Empire Creek | 0.5 | 0.0 | 0.0 | 1.1 |
| Woodside Glen | 0.0 | 0.5 | 0.0 | 0.2 |

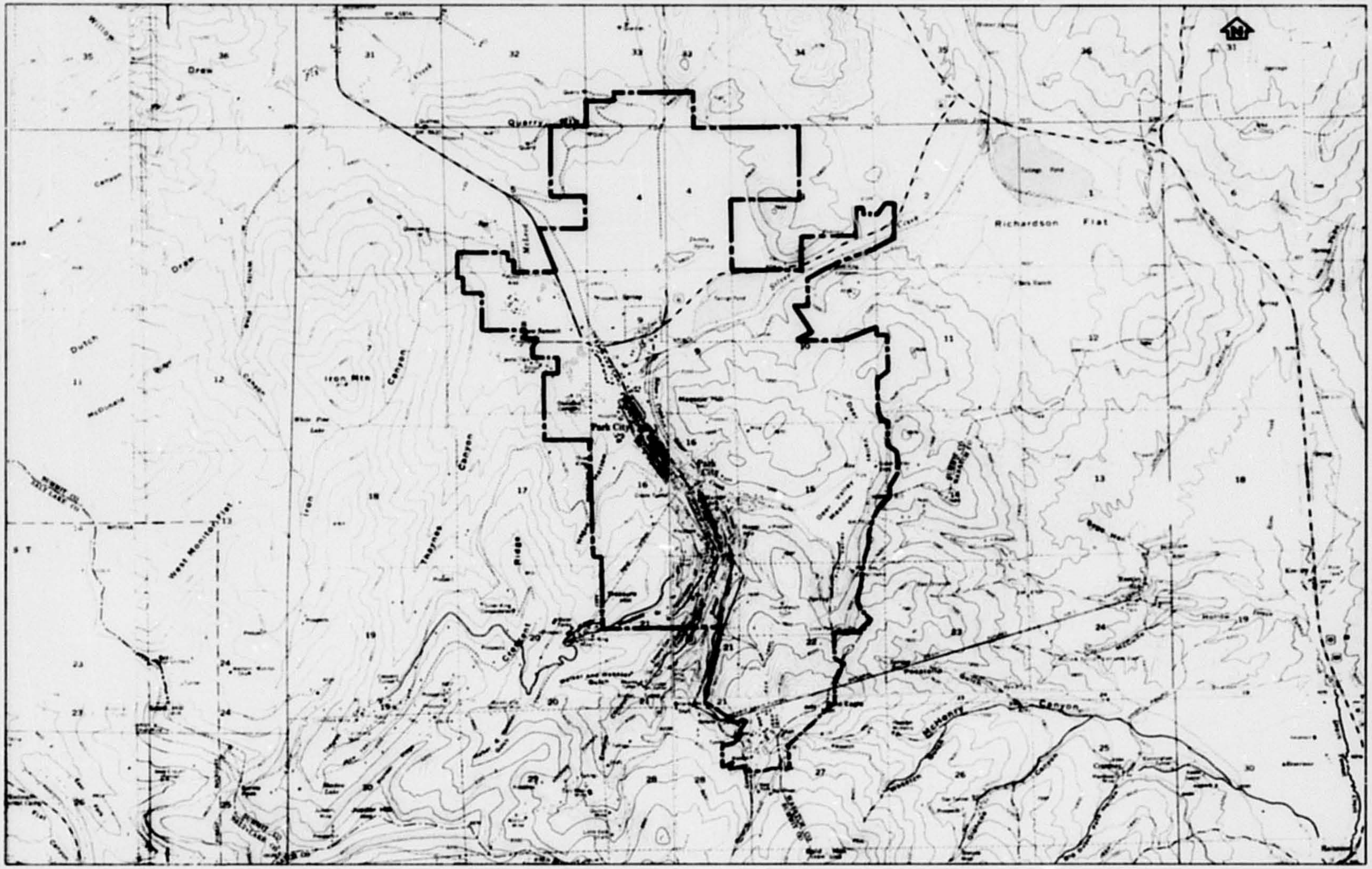


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**CITY OF PARK CITY, UT**
**(SUMMIT CO.)**

APPROXIMATE SCALE

1 0 1 2 3 MILES

**VICINITY MAP**

## 2.2 Community Description

The community of Park City is located in north-central Utah on the eastern slope of the Wasatch Range. It is in the extreme western portion of Summit County and is approximately 10 miles east of Silver Fork; 24 miles north-northwest of Heber City, the county seat; and 30 miles east-southeast of Salt Lake City, the State capitol and the closest major metropolitan area. Park City is contiguous to Summit County, Utah to the north, east, and west, and Wastach County, Utah to the southeast.

The community had its beginning in 1868 when silver was discovered above Parleys Park by some prospector-soldiers from a military establishment in the region. Although the filing of claims started soon after the discovery (the first in December 1868) the Ontario Mine strike in 1872 was the real impetus that led to the resultant silver rush and, eventually, the biggest silver mining camp in the nation's history. Since the initial discovery, the surrounding mountains have been mined extensively and, over the years, more than $400 million in silver has been extracted from the richly veined earth, producing 23 millionaires.

With the exceptionally good yield from the early mines, especially the Ontario mines, many new claims were staked out and, concurrently, tents, shanties, and the camp population increased rapidly in number. The continued success of the existing mines and additional ore discoveries hastened residential and commercial development in the community. The temporary early living facilities were replaced by sturdier, more permanent structures, and commercial activities and establishments to serve the growing populace expanded rapidly. The population exceeded 5,000 people by the early 1880's and, on March 8, 1884, Park City was incorporated.

Shortly after the start of the 20th century, consolidation of some of the smaller mining interests was begun in an effort to withstand worsening economic conditions. Silver prices have risen and fallen sporadically since that time and, after 1929, mining activities declined drastically. Through the years, major fluctuations in the price of silver have had a direct bearing on the decline or increase in mining activities and, associated community growth. A prolonged miners strike in 1949 and a severe decline in the price of silver in 1950 caused mining operations to practically cease, much of the population to leave town, and many businesses to shutdown. The city remained rather somnolent until the late 1950's when it gained renown as a weekend vacation spot and then evolved into a bedroom community of the Salt Lake City region. Eventually, a combination of the surrounding snowcapped slopes and some enterprising ski entrepreneurs resulted in the development of a booming ski industry.





The first ski lift in Park City was constructed in 1945 in the Deer Valley region. However, it was the development of Treasure Mountain Resort in 1963 (changed to Park City Ski Resort in 1971) that led to a transformation in the economic base in the 1970's from the mining industry to a ski-oriented recreational industry. Skiing and other recreational activities have been further enhanced with the opening of Park West Ski Resort in 1968 and Deer Valley Resort in 1981.

Park City now has many diversified activities geared toward year-round recreational enjoyment, especially winter sports. Vacationists, recreationists, and tourists now form the nucleus for the basis of the community's many faceted and resort area oriented economic stability.

The number of permanent city residents grew from 1,193 in 1970 to 2,823 in 1980 (an increase of almost 137 percent). However, during a peak winter-season month in 1981-82, the area population was about five times greater than normal, indicating the importance of seasonal recreational pursuits. Construction, especially of condominiums, is on the increase and is expected to continue in order to accommodate the housing and servicing needs of the transitory population.

The area is served by Interstate Highway 80, U.S. Highway 40, State Highways 224 and 248, and a network of city roads. Air service for Park City is provided by Salt Lake International Airport, which is about 45 miles to the northwest. Transportation within the city is available free of charge on the Park City bus system.

Park City is surrounded almost entirely by steep sloped mountains except to the northwest where it adjoins the broad expanse of Park Meadows. The variable city terrain is a contrast between high mountain peaks, deeply incised and narrow canyons with steep inclines, gently sloping valley floors, and fairly broad and flat meadow land. Deer and Frog Valleys extend south and north, respectively, along the eastern city boundary and terminate at Deer Valley Meadow. The meadow then tees to the west and intersects with Ontario Canyon. From the intersection, a widening valley continues northwesterly and ends in Park Meadows at the northwest city boundary. Elevations in the city range from approximately 8,250 feet, National Geodetic Vertical Datum (NGVD), in the southwest corner to about 6,800 feet in the northwest corner.

Most of the native vegetation in the lower valley and meadow lands has been obliterated because of urbanization, while on some of the surrounding slopes native vegetal cover has been drastically depleted due to mining operations and recreational activities. Dense coniferous forests predominate on the higher north-facing peaks, whereas, on the lower mountain slopes vegetation includes spruce, fir, aspen, oak, deciduous brush, and sagebrush. Vegetation in the lower elevations consists of cottonwood along streamways and willow and elderberry.

The general overall drainage in the study area is to the north. Deer Valley and the upper study portion of Silver Creek drain most of the eastern part of the city. Ontario Canyon, Empire Canyon, Woodside Glen, and the lower study portion of Silver Creek drain much of the southern and western parts of the city. Silver Creek, the principal stream studied, originates in Frog Valley at over 8,000 feet and follows a winding, S-shaped, northerly course through the study area for about 6 miles. From a headwater elevation of about 7,400 feet, Deer Valley Creek trends southerly for about 1 mile to join Silver Creek. Empire and Ontario Creeks start at about 9,200 feet southwesterly of the city, flow northerly for approximately 3 miles, and then merge with Silver Creek in about the middle of the city. Woodside Glen starts at over 9,000 feet just beyond the southwest corner city boundary and flows northeasterly about one mile to Empire Creek. Pertinent information on drainage area and stream gradients for the streams studied is shown in the following tabulation:

| Stream | Contributing Index Point | Drainage Area (square miles) | Average Gradient In Study Area (feet per mile) |
|---|---|---|---|
| Silver Creek | North city limit | 8.60 | 160 |
| Deer Valley Creek | At mouth | 1.64 | 20 |
| Ontario Creek | At mouth | 1.84 | 450 |
| Empire Creek | At mouth | 3.16 | 370 |

The high altitudes of Park City, 6,970 feet, and of the surrounding mountain peaks that rise up to 10,000 feet result in distinctive climatological variations. The climate is characterized as semiarid in the lower, valley elevations and subhumid in the highest headwater elevations. Normal annual precipitation (NAP) ranges from less than 20 inches on the low valley floor area of the city to about 45 inches at the headwater regions of Empire and Ontario Creeks in the southwest extremity of the study area. About 70 percent of the NAP occurs from October through April, generally in the form of snow. The average snowfall during that period exceeds 120 inches. Much of the summer precipitation occurs as cloudburst storms that normally last only a few hours.

Temperature in the Park City area ranges from average winter lows of about 14 degrees Fahrenheit to average summer highs of about 80 degrees Fahrenheit. Winter and summer temperature extremes have varied, respectively, from a low of -30 degrees Fahrenheit to a high of 100 degrees Fahrenheit The average daily temperature during winter is about 25 degrees Fahrenheit and during summer it is about 63 degrees Fahrenheit.





## 2.3 Principal Flood Problems

Flooding in Park City may result in the summer from localized cloudburst storms over one or more of the tributary drainage areas or in the spring from unseasonable, rapid melting of the snowpack in the higher basin areas.

Cloudburst storms sometimes lasting as long as 6 hours can occur in the study basin anytime between April and October, and may occur as an extremely severe sequence within a general rainstorm. Cloudbursts are high intensity storms that can produce floods characterized by high peak flows, short duration of flood flows, and small volume of runoff. In small drainage basins, such as are in this study, cloudbursts can produce peak flows substantially larger than those of snowmelt runoff. Cloudburst storms usually cover small areas; however, since the combined drainages in the study area collectively are less than 10 square miles, a cloudburst could cover the entire drainage area. Snowmelt flooding has a marked diurnal fluctuation in flow and is of much larger volume and longer duration (several days) than cloudburst flooding.

Park City has a long history of flooding, but little definitive data are available for specific floods. Due to the rural nature of the study area, the unavailability of streamflow records, sparse newspaper accounts, and the lack of contemporary accounts of floods, information on past floods is based essentially on brief newspaper accounts and eyewitness descriptions.

Since 1900 Park City has experienced approximately five memorable flood events, four cloudbursts and one snowmelt. The cloudbursts took place in July 1905, July 1913, August 1934, and May 1967 and the snowmelt runoff occurred in May 1983. The earliest record of flooding was in July 1905. At the time, it was reported in the Park Record, the local newspaper, that a thunderstorm over the Silver Creek canyon areas "lined the banks with fish of all sizes". On July 7-8, 1913, more than three inches of rain fell over the tributary drainages in the Park City area. The rainfall washed mud and boulders down from the mountain canyons and slopes, inundating urban areas and flooding streets and residential structures. A heavy downpour of rain following a hailstorm occurred on August 16, 1934, mainly causing road damage and interrupting traffic. A storm that occurred in late May 1967 caused high water to flow down Main Street in the central section of the historic district of Park City. The most recent flooding, caused by snowmelt runoff, occurred in the spring of 1983. Cooler than average temperatures during May of that year delayed the melting of a deeper than normal snowpack until the end of the month. Longtime residents of the area estimate that the flood flows on May 27 were higher than any others in the past 60 years. The high velocity flows eroded stream banks; damaged culverts, residences adjacent to the streamway, and the Heber Avenue bridge over Silver Creek; and deposited debris and silt on roadways and residential property. Sandbagging operations were conducted to prevent additional flooding. The estimated peak flow in town was about 150 cubic feet per second (cfs), which is estimated to have a recurrence interval of 50 years.

### 2.4 Flood Protection Measures

Due to the the realignment of State Highway 224 through town, about one mile of the Silver Creek channel downstream of Heber Avenue has been improved and leveed on the west bank.

FEMA criteria specify a minimum earthen levee freeboard of 3 feet when evaluating the ability of levee systems to provide protection against the 100-year flood. Park City currently has no levees which are certified to provide a 3-foot freeboard during such a flood. Any earthen levee that does not provide the specified 3-foot freeboard during a 100-year flood is assumed to fail. The floodplains in the vicinity of any failed levee reflect flood conditions as if no levee exists.

Some incidental flood control is provided by several surface water impoundments constructed in the study area, which store excess surface runoff. These impoundments were developed basically for aesthetic purposes. Small lakes and ponds are included as landscaping features of residential development in Deer Valley Meadow in the central eastern part of the city, and water hazard areas are incorporated as part of the design of the Park City Golf Course at the northwest edge of town.

Much of the surface runoff in the southern portion of the city flows via a storm drainage system into Silver Creek. Upstream portions of Silver, Deer Valley, Ontario and Empire Creeks contain noncontinuous underground conduits that control minor floods of less than a 10-year magnitude. Part of Woodside Gulch has an underground conduit that can carry flows that occur more often than every 10 years.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1 and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short





intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Flood hydrographs and peak flows for the 10-, 50-, 100-, and 500-year floods were based on computations of snowmelt and rainfall runoff and statistical analyses of synthetic cloudburst storms. Basin stream flow records are practically nonexistent and, therefore, were not used in this study. Procedures used included peak flow frequency curves, the unit hydrograph method of analysis, and Flood Hydrograph Analysis and Computations (Reference 1).

Snowmelt peak flow frequency curves were developed for streams in the Park City area using the criteria established in preparing similar curves for other streams in the general region that have many years of recorded flows and assumed similar statistical relationships to the streams in this study. Peak flow frequency curves were developed from both the estimated flows on Silver Creek and the recorded snowmelt peak flow frequencies for several gaging stations in the general region, using the same parameters. A comparison of all the curves verified the validity of the Park City estimates, and a 100-year peak flow of 175 cfs was extrapolated from the Park City curve. Previously computed 100-year snowmelt peaks on other streams in the general region, in conjunction with selected drainage area sizes, were used to develop a regional 100-year peak flow frequency curve. Using the regional curve as a model and incorporating the 175 cfs peak flow, a 100-year peak flow frequency curve was prepared for most Park City streams. Due to a smaller snowpack in Deer Valley, a separate 100-year peak flow frequency curve was developed for that area, using the regional curve as a model and a 100-year flow of 41 cfs.

Rainfall information for Park City is inadequate for this study. Therefore, precipitation amounts and areal reduction factors for computation of the 10-, 50-, 100-, and 500-year cloudburst floods were derived from data in the NOAA Atlas 2 for Utah (Reference 2). Rainfall distribution was based partially on the mountain area distribution pattern developed previously for another basin in the region.

Since runoff data for streams in the study area are nonexistent, loss rate data for the area were synthetically derived and based on previously computed loss rates for Big Cottonwood Creek in the Jordan River basin. That creek is on the opposite slope of the Wasatch Front from Park City, has years of precipitation and runoff records, and has assumed similar physical and hydrologic characteristics to the streams in the study area.

The unit hydrograph-excess rainfall method was used to compute flood hydrographs. Unit hydrographs were synthetically derived from regional and study area data and criteria. They were developed for all the streams studied and projected to specific index points on each stream. The unit hydrographs were based on an S-curve developed for a southeastern Nevada area and then shortened in length to more accurately depict Wasatch Front mountain drainage areas. Loss rates were based on the initial and constant loss concept and the analyses of soil cover and land uses.

Peak discharge-drainage area relationships for the streams studied are shown in Table 1.

TABLE 1. SUMMARY OF DISCHARGES

| Flooding Source and Location | Drainage Area (square miles) | Peak Discharges (cubic feet per second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Silver Creek | | | | | |
| At Bonanza Drive | 8.60 | 110 | 200[1] | 250[1] | 600[1] |
| Above confluence of Empire Creek | 1.64 | 70 | 310 | 610 | 2,310 |
| Above confluence of Deer Valley Creek | 1.27 | 30 | 100 | 190 | 650 |
| Empire Creek | | | | | |
| At confluence with Silver Creek | 5.19 | 70 | 210 | 450 | 1,680 |
| Above confluence of Ontario Creek | 3.16 | 60 | 200 | 440 | 1,650 |
| Upstream Study Limit | 2.40 | 40 | 120 | 250 | 1,000 |
| Ontario Creek | | | | | |
| At confluence with Empire Creek | 1.84 | 20 | 70 | 140 | 610 |
| Upstream Study Limit | 1.56 | 20 | 60 | 120 | 500 |
| Deer Valley Creek | | | | | |
| At confluence with Silver Creek | 1.27 | 20 | 80 | 150 | 630 |
| Upstream Study Limit | .66 | 30 | 80 | 160 | 660 |

[1]Reduced peak discharges due to permanent flow losses to McLeod Creek Basin. Losses originate at about the confluence of Silver and Empire Creeks and continue downstream to about Bonanza Drive. Combined channel and overbank peak discharges for the 50-, 100-, and 500-year floods will be 430 cfs, 900 cfs, and 3,470 cfs, respectively.





The computational methods and techniques used are acceptable procedures for hydrologic analyses and produced results considered reasonable for Park City. Unexpected findings were not encountered in carrying out the hydrologic analyses for this Flood Insurance Study.

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Flood elevations for the streams studied by detailed methods, except the steep-terrained upper reaches of Empire and Ontario Canyons and Deer Valley, were computed through the use of the U. S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 3). The slopes of those three streams in their higher reaches exceed the established parameter of the HEC-2 program. A stream slope that has a gradient of greater than 10 percent cannot be comprehensively modeled using the HEC-2 program. Thus, those stream sections were analyzed based on approximate analyses.

Cross sections for backwater analyses were located at close intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas presently urbanized or subject to development. Additional cross sections were located at other representative locations in the study area. Cross section data were derived from field surveys supplemented with topographic maps (Reference 4). Field reconnaissance was conducted to obtain structural data for culverts, low-water crossings, and foot bridges.

Roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field reconnaissance of the streams and adjacent floodplains in the study area by experienced engineers. The factors ranged from 0.035 to 0.08 for channels and from 0.08 to 0.10 for overbank areas. These roughness factors include engineering judgment for turbulence.

Starting water-surface elevations for Silver Creek were developed by the slope-area method. Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The evaluation of the 100-year floodplain for Woodside Glen, studied by approximate methods, was based on engineering judgment, which included the consideration of all available data and field observation.

Detailed study methods were terminated on Empire, Ontario and Deer Valley Creeks where the terrain on those streams became too steep, as previously explained.

Approximate flooding areas beyond the "Limit of Detailed Study" shown for Silver Creek, were determined primarily by Field Inspection using hand levels and estimates of flow from the detailed analyses.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries to assist communities in developing floodplain management measures.

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 40 feet (Reference 4).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE and AO); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries





are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2.)

Some areas in Park City particularly the area between Woodside Avenue and Silver Creek are subject to broad, shallow, overland flooding generally less than 3 feet deep and are characterized by unpredictable flow paths (sheet flow). North of Deer Valley Drive and Iron Horse Drive this sheet flooding continues generally less than 1 foot deep and does not return to Silver Creek but continues to the north to the McLeod Creek Basin. The water-surface elevations of flooding in these areas are essentially independent of those along the adjacent streamways and are affected principally by natural and constructed barriers to flow in the flooded areas. The flood boundaries in these areas were determined primarily by field observations considering break-out discharges and normal depth calculations. The various flood pattterns such as confinement to streamways and channels, ponding along obstructions, and lateral distribution of flood flows are shown on the Flood Insurance Rate Map.

### 4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

Floodways were not determined for this FIS due to the following conditions. For much of the study area, sheet-flow flooding occurs adjacent to streamways and floodways cannot be established in sheet-flow areas. Containment of such flows within the streamways would result in exceeding the 1.0-foot rise criterion. Also portions of Empire and Ontario Canyons and Silver Creek are composed exclusively of various sized underground conduits. Any flows in excess of the conduit capacities result in overland flow that is not related to the channel and the establishment of floodways is precluded.

## 5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.





For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, and the locations of selected cross sections used in the hydraulic analyses.

## 7.0 OTHER STUDIES

A Flood Hazard Boundary Map (Reference 5) has been published for the City of Park City. It shows 100-year flood delineations, as determined by approximate methods, for portions of Silver Creek, Ontario Creek, and Deer Valley Creek that are within the corporate limits of the city.

A Flood Hazard Boundary Map (Reference 6) has been published for Summit County. It shows 100-year flood delineations, as determined by approximate methods, for portions of Silver Creek that extend beyond and north of the city limits but are included as part of this study.

The data in this study, due to its more detailed analyses, supersede the data shown on the Flood Hazard Boundary Maps for Park City and Summit County.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

## 9.0 BIBLIOGRAPHY AND REFERENCES

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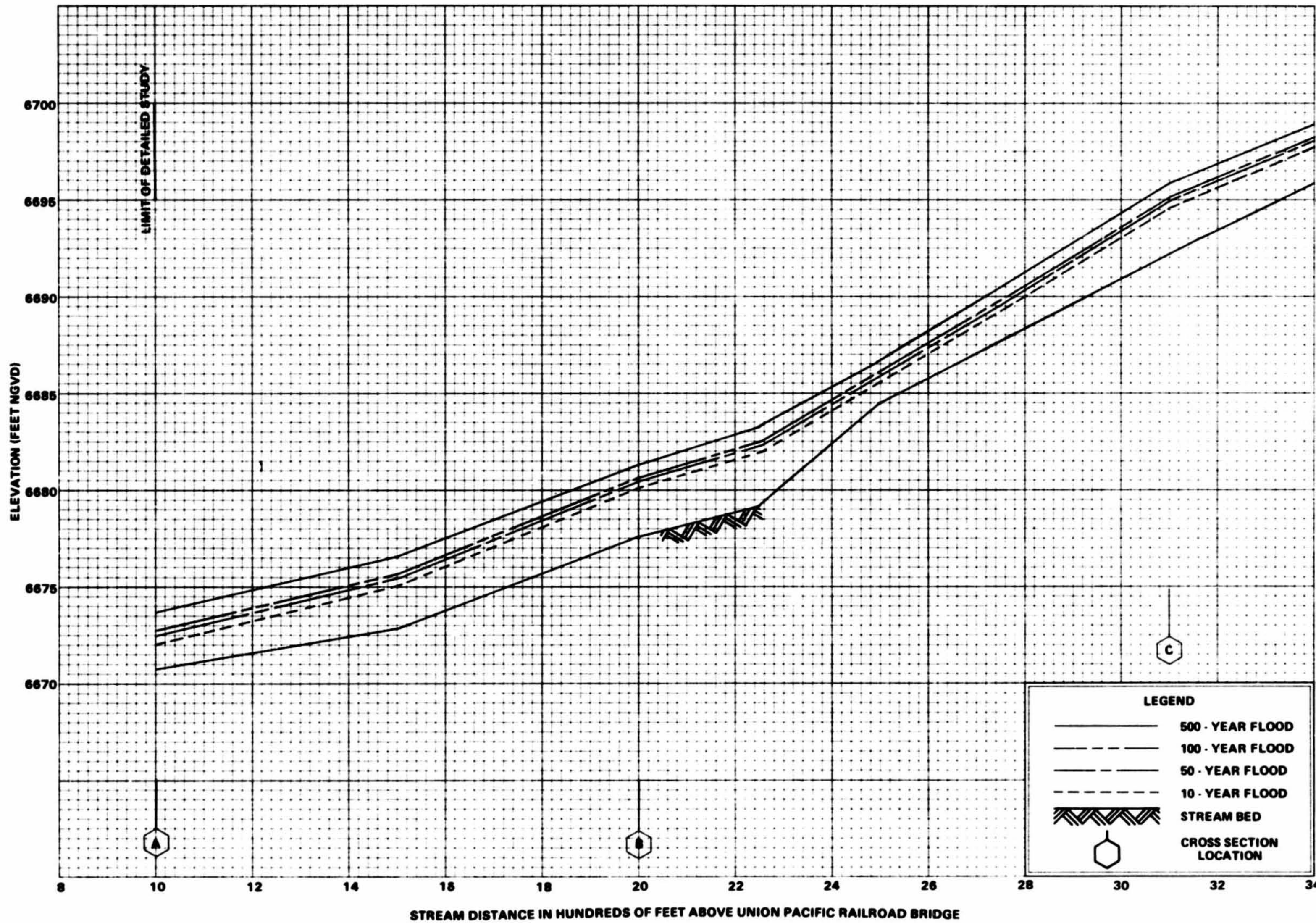


FLOOD PROFILES

SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PARK CITY, UT
(SUMMIT CO.)

01P



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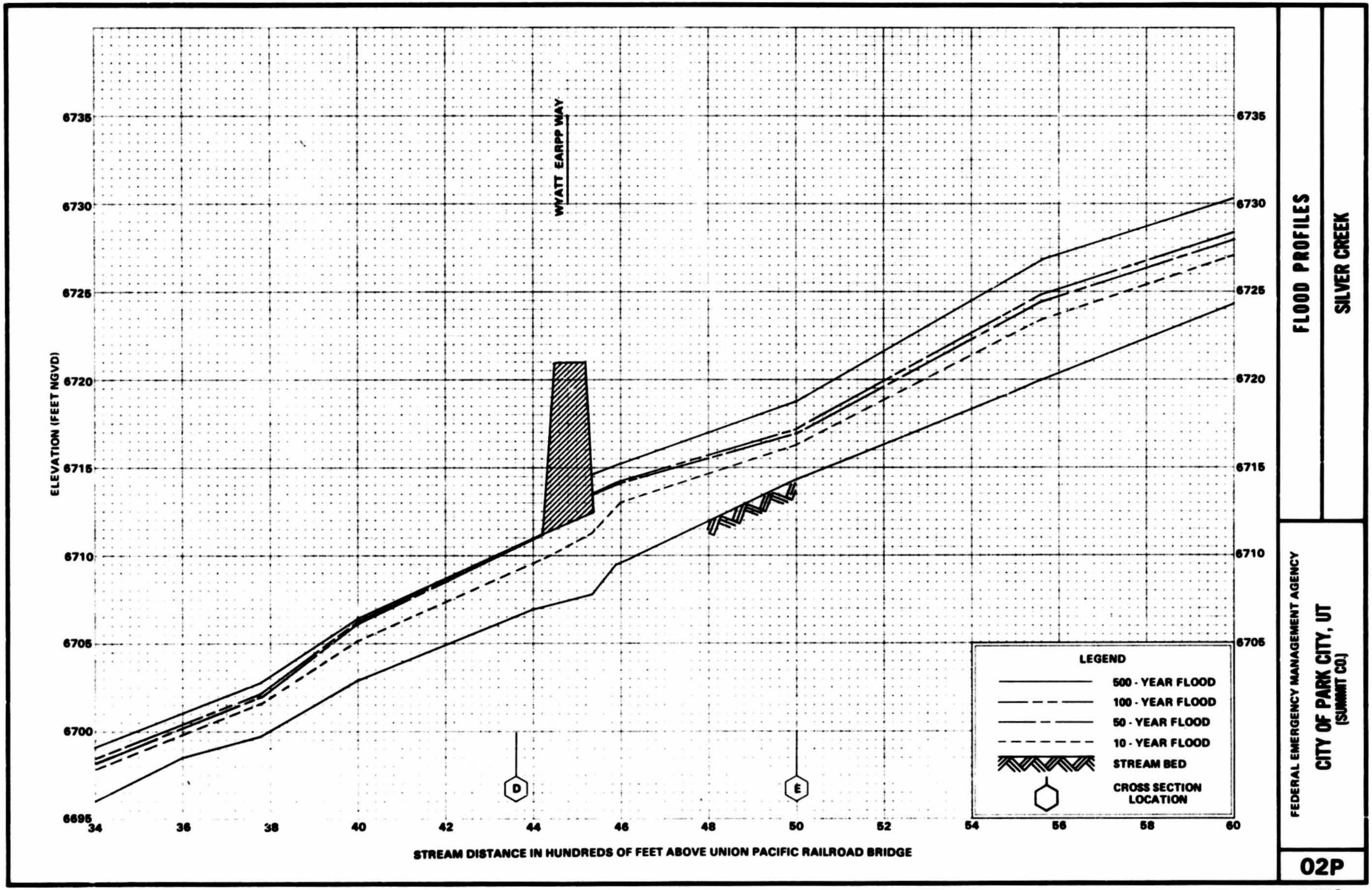




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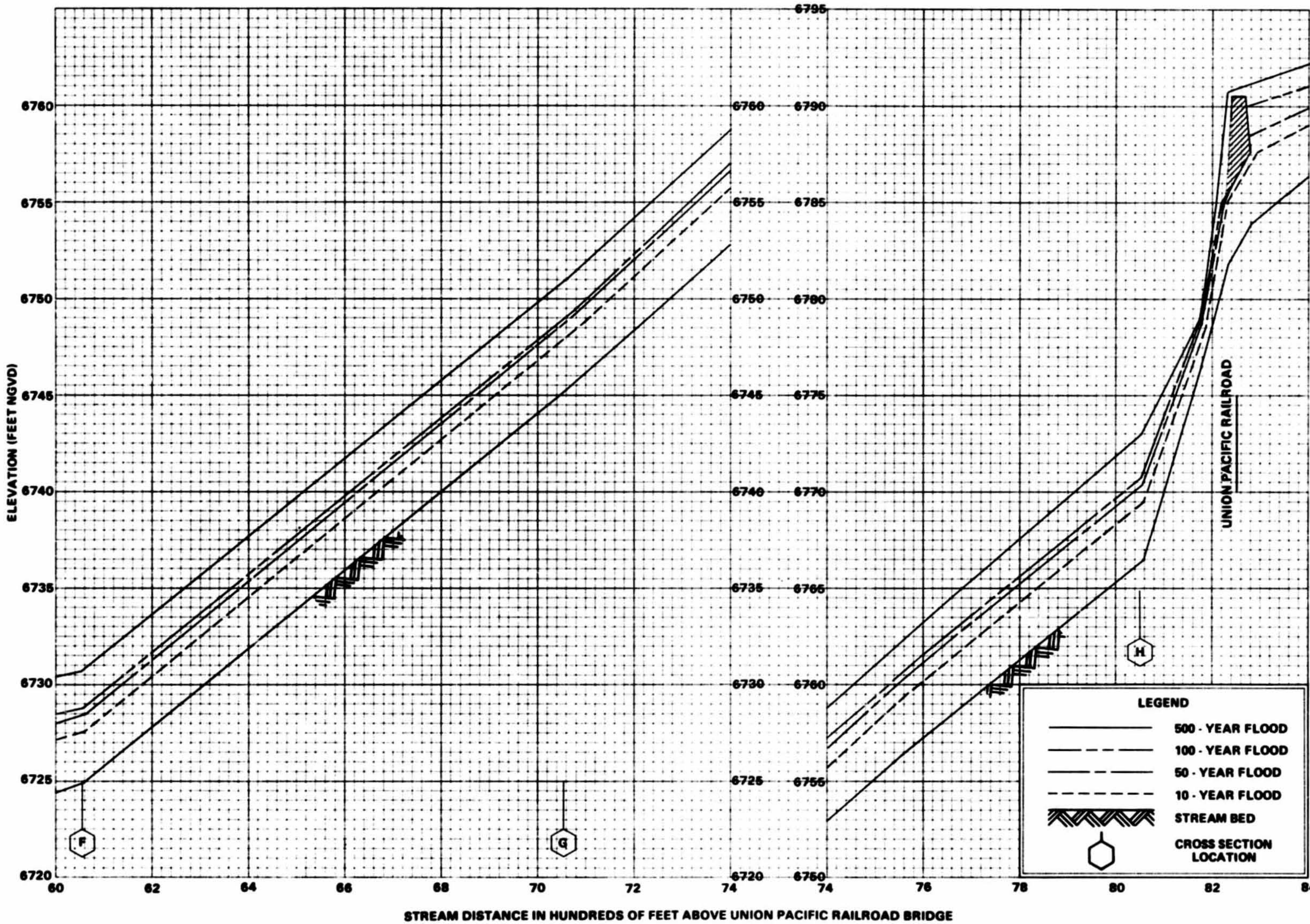


FLOOD PROFILES

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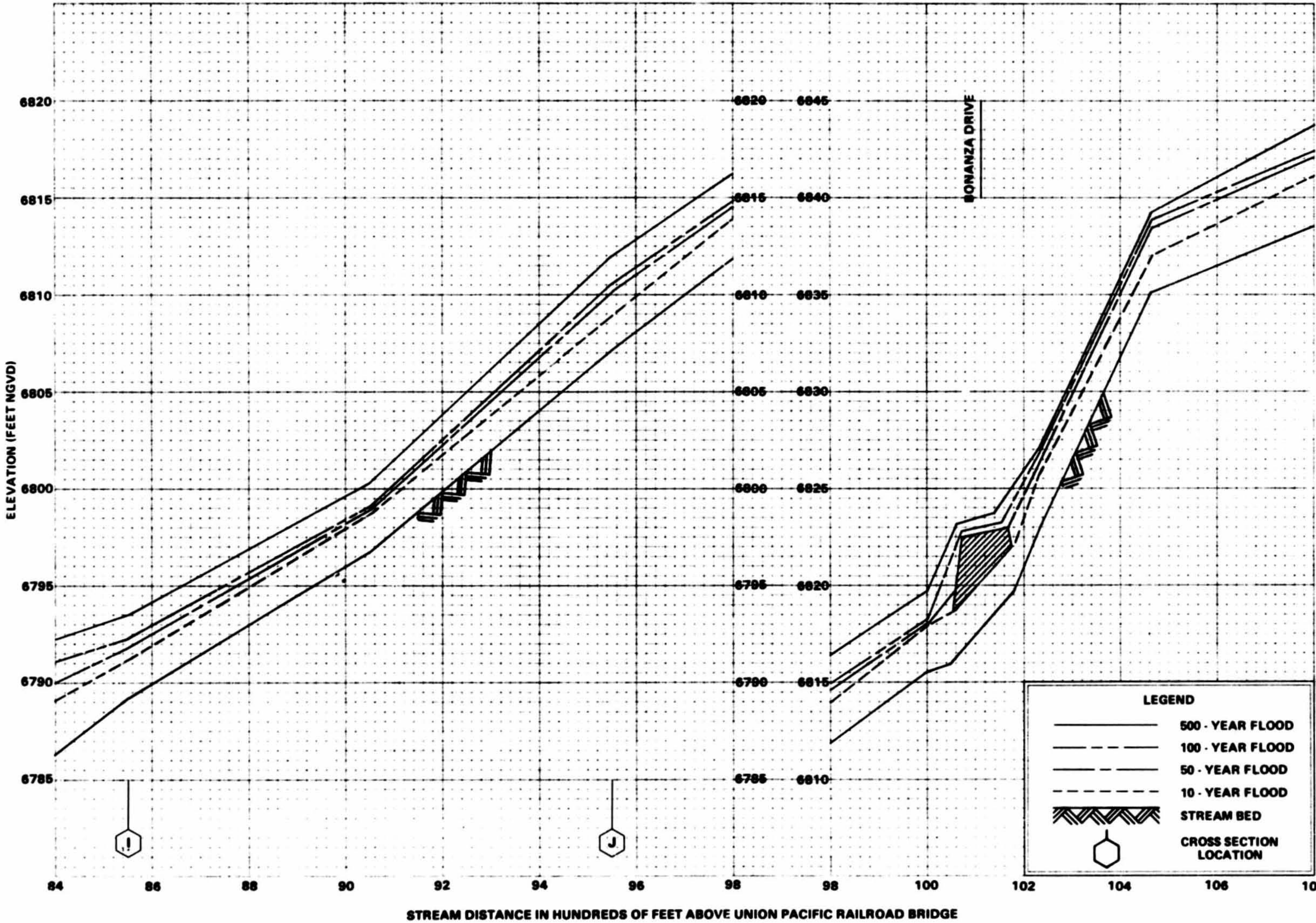


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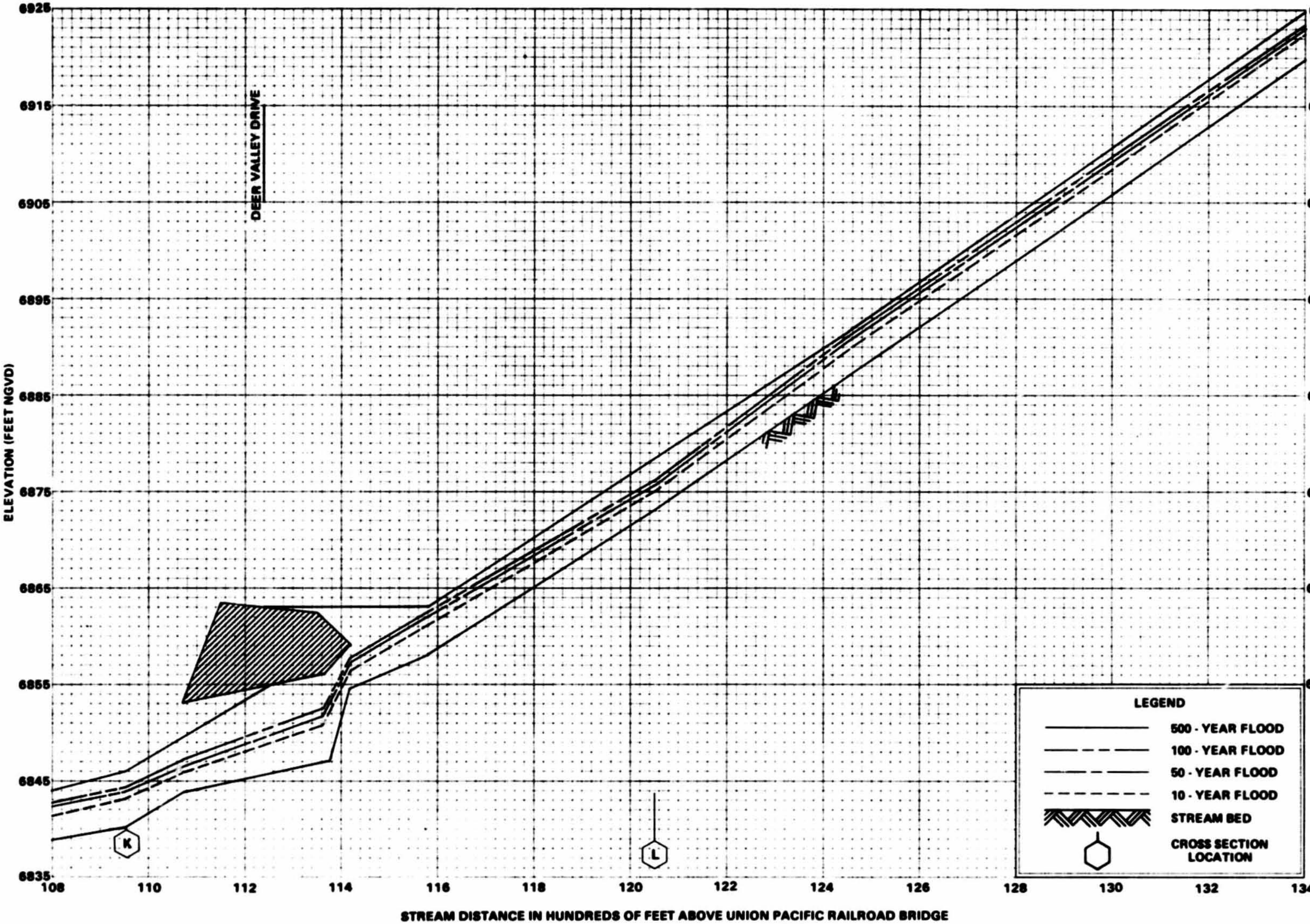


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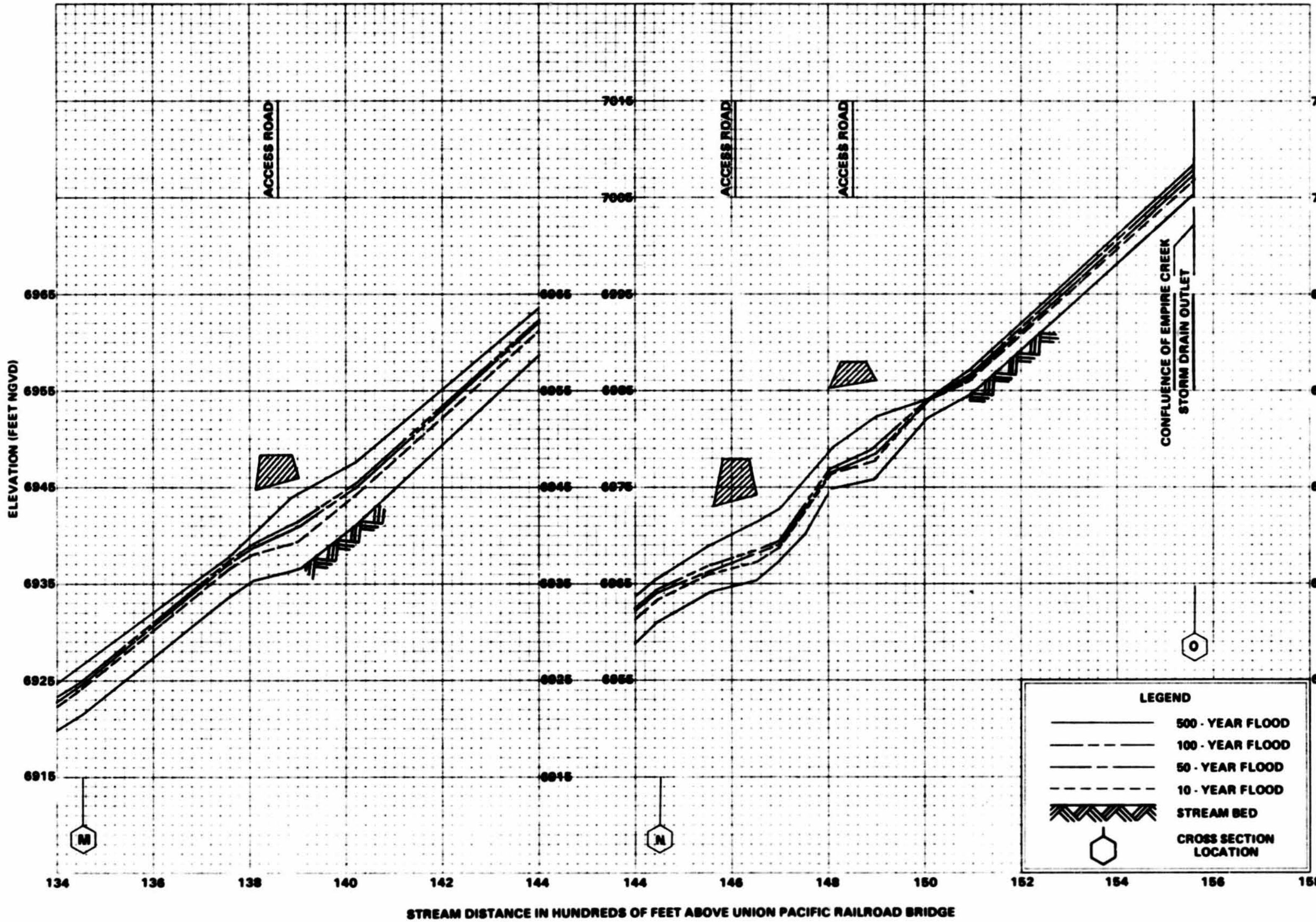


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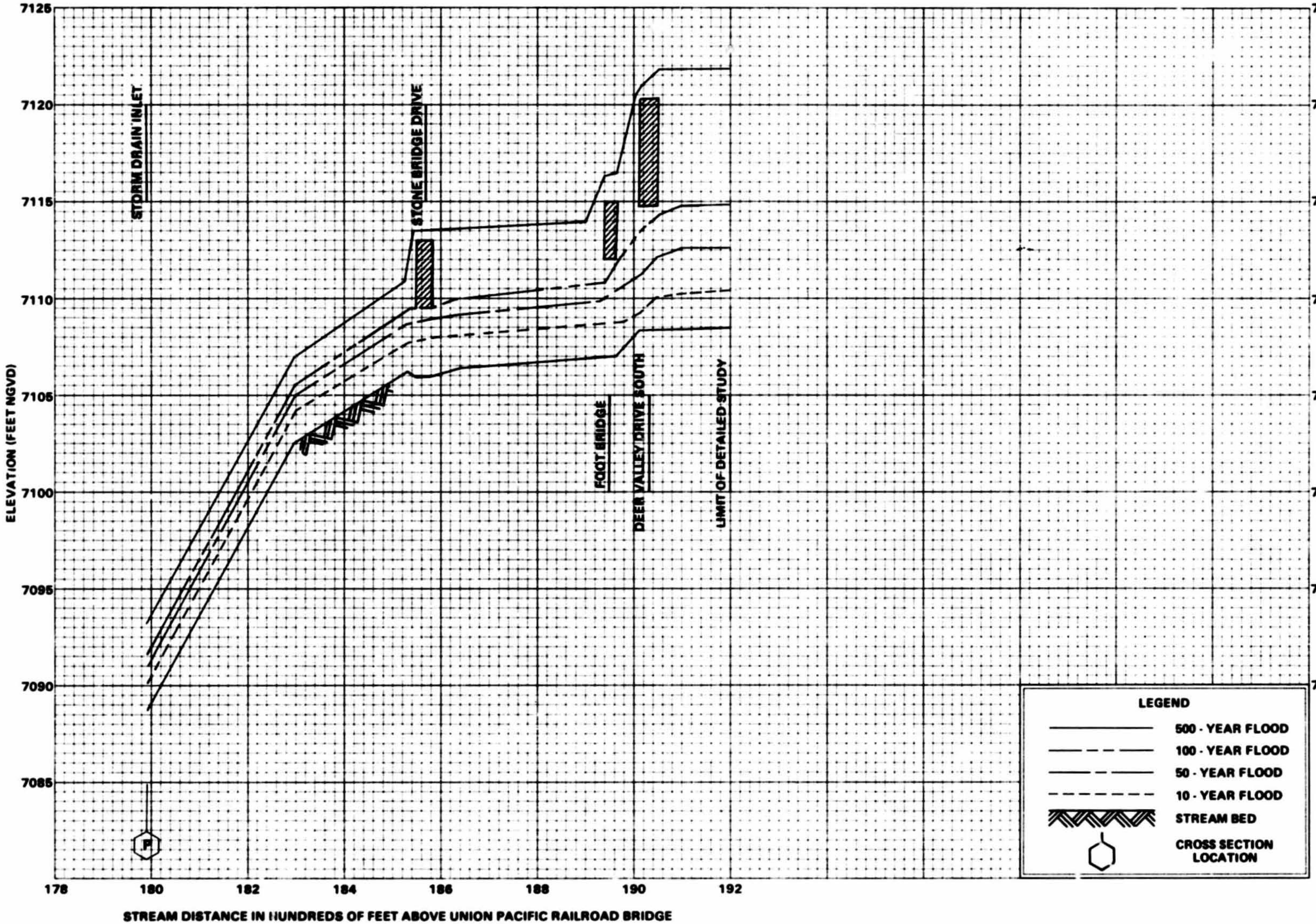


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**EXHIBIT 3 - ELEVATION REFERENCE MARKS**
**CITY OF PARK CITY, SUMMIT COUNTY, UTAH**

| Reference Mark | Elevation (feet NGVD) | Description of Location |
|---|---|---|
| RM 1 | 6707.00 | Rim of a sewer manhole on the Silver Creek trunk sewer line approximately 270 feet east of the prospector sewer lift station, a small building east of Wyatt Earp Way. |
| RM 2 | 6883.04 | A metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and North Street (14th Street). |
| RM 3 | 6990.28 | A metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and Calhoun Street (13th Street). |
| RM 4 | 6918.82 | A metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and Nelson Street (12th Street). |
| RM 5 | 6934.32 | A metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and Crescent Street (11th Street). |
| RM 6 | 6968.18 | .. metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and Shepard Street (9th Street). |
| RM 7 | 7007.96 | A metal disk set-in-concrete monument with ring and lid in the center of the intersection of Park Avenue and Heber Avenue. |